REMARKS

The Amendment:

Claim 1 has been amended to define the liquid carrier in greater detail and to recite that the heating step of the coating is sufficient to heat both the coating and the outer skin of the coated surface to their melting temperature thereby fusing the coating into the outer skin of the object. Support for the amendment appears on page 8, lines 21-25.

Claim 6 has been amended to recite that the coating, which is applied to the interior surface of a rotational mold is transferred from the interior surface of the mold and permanently fused into the surface of the polyethylene object which is formed in the mold. Support for the amendment appears on page 8, lines 10-13.

Newly added claims 23-25 recite that the anti-microbial coating is applied to the surface of a rotational mold by spraying with a liquid solution of the composition dissolved in a hydrocarbon solvent. Specific support for these claims appears in Example 2, page 10.

The Invention

Applicant's invention is a cost effective treatment to impart a permanent antimicrobial coating to polyethylene objects. An antimicrobial agent is admixed with a polyethylene fusible solid and the mixture is suspended or dissolved in a liquid carrier to obtain a coating composition which is applied to the polyethylene object to deposit a coating having a thickness from 0.1 to 5 mils onto the surface of a preformed polyethylene object (as recited in claims 1-7, 15 and 17), or to the interior surface of a rotational mold cavity used to form the polyethylene object (as recited in claims 8-14, 16 and 18-21).

When applied to the surface of a preformed polyethylene object, the coated surface is heated to the polyethylene melting point to fuse the coating into the

surface of the polyethylene object (from 250° to 550° F.; see page 8, lines 4-20).

After the coating is applied to the interior surface of a rotational mold cavity, the mold is heated to the melting temperature of the polyethylene; see page 7, lines 16-26 and Example 2, page 9, lines 14-19. The polyethylene object is formed against the interior walls of the rotational mold during the molding cycle, and the anti-microbial composition transfers from the rotational mold surface to, and is permanently fused into, the surface of the polyethylene object.

Because only a thin coating of the antimicrobial composition is applied to the polyethylene object, its physical properties are not degraded, in contrast to the prior art technique where the anti-microbial additive is incorporated in the molding resin. Applicant's treatment is very economical since applicant employs only a minor amount of the relatively expensive antimicrobial agent, again in contrast to the prior art in which the anti-microbial agent is dispersed throughout the entire molding resin.

The Rejection

Claims 1-7, 15 and 17 were rejected under 35 U.S.C. §103 as unpatentable under 35 USC §103 as considered to be obvious to one skilled in the art from the teachings of Cummings et al in view of Oikawa et al and Gupta.

Claims 8-14, 16 and 18 were rejected under 35 U.S.C. §103 as unpatentable under 35 USC §103 as considered to be obvious to one skilled in the art from the teachings of Cummings et al in view of and Zwart.

Claims 19 and 21 were rejected under 35 U.S.C. §103 as unpatentable under 35 USC §103 as considered to be obvious to one skilled in the art from the teachings of Cummings et al, Gupta, Lowes, or Oikawa in further view of Oakes et al.

The References:

Cummings et al disclose the application of an anti-microbial agent by electrostatic powder coating followed by heating to fuse the powder into a coating. The examples show coating of steel coupons and the application teaches that the treatment can be applied to metal and non-metal objects. Treatment of polyethylene or any plastic is not disclosed.

Oikawa et al discloses a laminate of a steam impervious film bonded to a steam pervious film of low density polyethylene by a polyurethane adhesive which contains an anti-microbial compound. The polyurethane adhesive is a two part, reactive adhesive; no heating is applied or necessary to cure the adhesive.

Gupta discloses that a solution of an anti-microbial agent can be incorporated into a masterbatch of polyethylene. This results in a uniform dispersion of the additive throughout the entire masterbatch of polymer. The masterbatch is then blended with other polymers to provide 1-10% anti-microbial agent in the final mixture used to manufacture fibers or paints.

Lowes discloses an acrylonitrile spinning solution which contains about 5% of a bacteriostatic agent. The spinning solution is extruded through a spinnerette to form acrylonitrile filaments having the bacteriostatic agent dispersed throughout the filaments.

Zwart discloses rotational molding in which a coloring additive and an anti-microbial agent are incorporated in the molding resin resulting in a molded product in which the expensive anti-microbial agent is dispersed throughout the entire molding resin at a concentration about 0.05% (Example 1 and 2).

Oakes discloses coating an object with an aqueous, colorless paint which is loaded with a germicide. The examiner has cited this patent for an asserted prior art use of hydrocarbon solvents, however, applicants' attorney is unable to locate such disclosure. Instead, the patentee states that an aqueous solution, or

generally aqueous system is used (col. 3, lines 32-34). The coating is not fused into the product, as it is readily removed by a mild acid wash (col.7, lines 50-53).

Applicants' Arguments:

As to claims 1-7, 15, 17, 19 and 21:

Enclosed with this response are the following internet publications on powder coating:

Pro-Coatings, www.procoatings.com, p1,2;

Nordson, Powder Coating Process, www.nordson.com, p1; and

Special Chem, www.specialchemcoatings.com, p1,2.

These publications are submitted to evidence the powder coating technique which is evidently so commonly understood that even Cummings did not need to submit a detailed explanation of the technique in his patent. Briefly, the technique has two major steps; first, the spraying of dry, finely ground particles of pigment and resin through a spray gun which electrostatically charges the powder and sprays the powder onto a part which is electrically grounded; and second, heating of the deposited powders to cause them to flow and fuse into a smooth, continuous coating.

These publications establish points which are material for consideration in analyzing the combination of prior art applied by the examiner. These points are:

(1) a heating step is an essential step in the powder coating process; without heating, the particles will not flow together and can be blown off or vacuumed from the part; see the Nordson publication;

(2) foam, rubber, plastic, and paper can not be powder coated since these materials cannot withstand the high temperature exposure necessary to cure the powders; see the last paragraph of the Pro-Coatings publication. .

Cummings does not suggest powder coating of polyethylene objects. Those skilled in the art know that powder coating cannot be applied to plastics as plastics cannot withstand the temperatures essential to cure powder coatings. Yet the examiner persists in stating that it would have been prima facie obvious to one of ordinary skill in the art to coat Oikawa's polyethylene article during Cummings' process. Clearly this is not a proper combination of prior art teachings. Attempting to powder coat Oikawa's polyethylene would not be obvious to one skilled in the art.

The examiner has suggested that it would have been obvious to one skilled in the art to have attempted to use Gupta's liquid carrier in Cummings' coating process. This is not only unobvious, it would be impossible. Powder coating must use dry, finely ground particles which will attract an electrostatic charge which is essential to attach the particles to an electrically grounded article. A liquid cannot be substituted for dry powders in the powder coating process. If the examiner is suggesting that the substitution of a liquid for the powder used by Cummings would also include substituting a liquid sprayer for the electrostatic powder sprayer of Cummings, then the examiner must concede that the heating step of Cummings must be deleted, as the only purpose of the heating step is to cause the particles of the dry powder to flow together and form a continuous coating.

The examiner has also asserted that Cummings discloses heating the powder coated surface of an article for sufficient time to fuse the coating into the wall of the article (last two lines, p. 2 of the Office action). By definition, this is impossible. The applicable definition of "fuse" is: "to blend by melting together." Steel, as substantially all metals, does not melt at the temperatures specified by Cummings. In contrast, applicants' invention achieves fusion since a surface of a polyethylene object and an anti-microbial coating containing 95-99.5% of a

fusible solid are to the melt temperature of polyethylene.

The examiner suggests that substitution of Gupta's liquid for the powder of Cummings would have been obvious to avoid possible hazardous ventilation situations that can arise in powder applications (lines 18-19 on page 3 of the Office action). No support for this statement is offered by the examiner and the statement does appear to be contrary to the stated advantages of the powder coating technique; see page 2 of the Special Chem publication where it is stated that powder coating process has environmental advantages over liquid coating processes since powder coatings contain no solvent and emit negligible volatile organic compounds and thus do not need venting, filtering or solvent recovery. If the examiner persists in maintaining the rejection on this supposition of hazardous ventilation, applicants respectfully request that the supposition be supported by evidence.

<u>As to Claims 8-14, 16 and 18</u>:

Claim 8 and its dependent claims recite a process wherein a coating of the anti-microbial agent and polyethylene fusible solid is transferred from the interior surface of a rotational mold into the surface of the polyethylene object which is formed in the mold. Cummings teaches that heating of a dry powder coating of an anti-microbial agent causes the coating to adhere to a metal surface. This does not suggest that a coating on the metallic rotational mold surface could transfer to the object which is formed in the mold. To the contrary, it suggests that such a transfer would be unlikely.

Zwart teaches that if one skilled in the art wishes to impart an anti-microbial activity to a plastic object formed in rotational molding it is necessary to mix the anti-microbial additive throughout the entire resin used to form the molded object. This is precisely the approach which applicants avoid. Most rotationally molded products have walls which are at least 3/16 inch thick. Zwart

must disperse the anti-microbial agent throughout the entire thickness of the walls of the molded product. In contrast, applicants' invention incorporates the anti-microbial agent in a coating which is from 1.5 to 5 mils thick, which permits applicants to concentrate the anti-microbial agent at the surface of the polyethylene object, thereby using less of the expensive agent and avoiding degradation of the physical properties of the polyethylene resin.

Applicants acknowledge that claim 8 and its dependents (except for newly added claims 23-25) are not limited to use of a liquid carrier for the anti-microbial agent and fusible solid. The argument for patentability of these claims is that the combination of Cummings and Zwart does not suggest to one skilled in the art that a coating of anti-microbial additive applied to the interior surface of a rotational mold could be successively transferred during the molding step from the mold surface into the surface of the molded object. Cummings discloses that a coating can be bonded to a metal surface by heating to substantially the same temperatures used during a rotational molding cycle, one skilled in the art would not obviously expect that a transfer of the heated coating from the metal surface of the mold to the polyethylene object would not occur. Zwart does not overcome this expectation, because Zwart teaches that if one wishes to impart an anti-microbial activity to a rotationally molded object, an anti-microbial additive must be mixed into the molding resin. This reference is the antithesis of obviousness of applicants' invention as recited by claim 8, since it teaches a practice which uses excessive amounts of the anti-microbial additive and risks impairment of the physical properties of the molded object..

<u>As to Claims 23-25</u>

Claims 23-25 which have been added in this response recite that a liquid is sprayed against the rotational mold surface, and all of applicants' arguments for patentability set forth with regard to claim 1 and its dependents, also apply to the

patentability of these claims.

Summary:

The claims clearly define patentable invention over the prior art in that one of ordinary skill in the art would not obviously attempt to substitute the polyethylene film of Oikawa's laminate for the steel coupons which are coated by a power coating process in the Cummings' patent. As the cited publications evidence, such an attempt would be contrary to the knowledge of one skilled in the art and would, most likely be inoperative, as the polyethylene film would be destroyed by the heat treatment required in a powder coating process.

Claim 8 and its dependents recite further invention in that these claims recite coating of the inside surface of a rotational mold with a coating which transfers from the mold surface into the wall of the polyethylene object formed in the mold, which is a most unobvious result, based on the prior art's knowledge of the Cummings and Zwart patents..

It is believed that the claims are of proper form and scope and define invention over the prior art for the reasons set forth in this response. Examination and allowance are solicited.

April 29, 2005

Respectfully submitted,

/Robert E. Strauss
Reg. No. 19,364

Powder Coating Center

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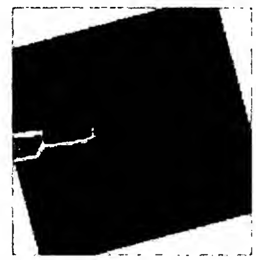
- Powder Coating Center
- Comparative Economics
- Markets / Application
- Powder Coating Process
- Formulation
- Future Trends



The technology for coating products with dry powder rather than conventional liquids has been available since the 1950's. The powder used for the process is a mixture of finely ground particles of pigment and polymeric resin. The powder is either sprayed electrostatically onto a surface to be coated, or the substrate is dipped into a fluidized bed of suspended powder. The powders adhere to a preheated substrate surface in the fluidized bed process, or they adhere electrostatically in the spray process. When heated further in a curing oven, the particles flow and fuse into a strong, adhering coating. The result is a high quality coating with an attractive finish and excellent durability.

The growth of powder coatings has been dramatic during the last two decades with new applications continually being developed for both industrial and consumer related markets. The growth can be attributed to the powder coating industry meeting customers' demands with a two-pronged attack:

1. The development of new formulations and
2. The development of advanced equipment and application processes.

These developments have created many new market opportunities and helped overcome finishing obstacles that were common in the early days of the powder coating industry.

Powder coatings have been shown to possess significant durability and resistance to abrasion, corrosion, scratching, and chemicals when compared to liquid coatings. Powder coatings stay bright with less fading, and color selection is virtually unlimited with high and low gloss, metallic, and clear finishes available. Texture selections range from smooth surfaces to wrinkled or matte finishes, and rough textures are available for hiding surface imperfections. Thick coatings can be achieved quickly and efficiently.

Although the final properties of the powder coatings are often superior to liquid coating systems, the reason for the fast growth of this technology has been more related to the evidence that powder coatings maximize production, cut costs, improve efficiencies, and offer maximum compliance with increasing stringent environmental regulations - factors

all related to the end-user's bottom line.

Environmental advantages have led the way for the conversion of liquid coatings to powder coatings. Powder coating contains no solvent, and thereby the process emits negligible, if any, polluting volatile organic compounds (VOCs) into the atmosphere. Furthermore, the processes used for powder coating do not require venting, filtering, or solvent recovery as is necessary with liquid finishing. Costs are saved because there is less need for heating outside air to supply oven exhaust air, and most of the powder coating over-spray can be retrieved and re-used.

Table 1 summarizes the advantages and disadvantages of powder coatings. Recent developments in materials and process technology have greatly minimized the disadvantages that are listed here. These developments are summarized in this article.

Advantages	Disadvantages
No solvents so that VOCs are nil	Very thin coatings (less than 1.0 mil) are difficult because of pinholes
Exhaust air from the coating booth can be returned to the coating room, thus less oven air is exhausted to the outside	Frequent color changes could entail extensive downtime
Over-spray (up to 98%) can be retrieved and reused	Storage and handling of powder requires special climate controls
No drying or flash time required so that parts can be racked closer together	Color matching and color uniformity is somewhat more difficult than with liquid coatings
Easily adapted to continuous, automatic processes	Uniformity of coating thickness is sometimes difficult to maintain
Coating does not run, drip, or sag, thereby lowering rejection rates	Cure temperatures required for some powders are too high for temperature sensitive parts
Minimum operator training and supervision	Powder coating is difficult on sharp corners
Thick coatings are easily possible	Conversion from liquid coating processes is expensive
High throughput / output options	Inside corners have low film thickness owing to the Faraday cage effect
Simple clean-up and maintenance	

Table 1: Advantages and Disadvantages of Powder Coatings

Nordson

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Nordson Home ➤ Businesses ➤ Powder Coating ➤ Powder Coating Process

Powder Coating Process

Powder coating is a method by which electrically charged powder coating material is spray-applied to a grou work piece. Electrostatic attraction holds the powder to the part to be coated until heat is added to flow the powder together and cure it.

Since powder may adhere to the part for several hours, heat curing can be done at the user's convenience. Should the uncured powder coat become damaged or blemished during handling, the powder can be simply blown off with air or vacuumed, and a new coat applied.

System Components

An electrostatic powder coating system is comprised of a powder feeder, power unit or electrostatic voltage generator, electrostatic spray gun(s), and a powder recovery system.

Feed center

In the feed unit, powder is diffused by compressed air into a fluid-like state. It is then siphoned out by the movement of high velocity air flowing through a venturi and propelled through powder feed tubing to the spr gun.

The feeder provides a controlled flow of powder to the spray guns. Since powder and air volume are independently controlled, dilution ratios can be adjusted to obtain the desired thickness coverage needed to specific production requirements. The feeder can provide sufficient discharge pressure and velocity to feed as remote as 50 feet away.

Power unit

A high-voltage, low-amperage power unit supplies an electrode at the front of the gun. As the powder leaves gun, the electrode emits a field charge that is imparted to the coating material as it is propelled toward the p Once charged, the powder particles are drawn and attach themselves to the grounded work piece.

The power unit has sufficient voltage to assure maximum wraparound. Voltage is operator adjustable up to kV to minimize Faraday Cage effect when spraying into corners and deep recesses, and to ensure excellent wraparound and surface coverage on all surfaces being sprayed.

Spray guns

Electrostatic powder guns are designed to shape the spray pattern and impart an electrostatic charge to the powder. The spray pattern is easily configured to accommodate the type of coating used and the shape of tl part being coated.

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Powder Coating Service

Pro-Coatings is an industrial and custom powder coating company. We specialize only in powder coating, with a committment of providing affordable, superior coatings and to serving our customers needs.

What is Powder Coating ?

Powder coating is a method of applying a decorative and protective finish to a wide range of parts.The powder used for the process is a mixture of finely ground particles of pigment and resin, which is sprayed with a special spray gun that electrostatically charges the powder. The charged powder particles adhere to the electrically grounded parts until heated and fuse into a smooth coating in a curing oven. Resulting in a smooth continuous coating that is highly durable, scratch and chip resistant. Powder coating is the fastest-growing finishing technology in North America.

Why Powder Coating?

Powder coating is significantly more durable than conventional paints. It is extremely resistant to chips, abrasion, heat up to 400° F , UV light, fuel and chemicals - up to 10 times more durable than ordinary paint. Powder coating eliminates runs, drips and sags common with paint finishes. Also, corrosion resistance properties are difficult to achieve with other methods or materials. Wide selection of colors **available including OEM, translucent, and metallic. Powder coating is environmentally friendly, there are no solvents or hazardous material used.**

Part Preperation

Because the powder adheres electrostatically, it must be applied to a very clean surface. It will not cling well to old paint, primer, most metal fillers or rust. Chemical stripping and/or sandblasting of the surface is recommended. The coated parts are cured in an oven at 400-500 degrees Fahrenheit for up to 20 minutes or more. Any materials that cannot withstand this time and temperature exposure must be removed before coating. This would include foam insulation, rubber, plastic, bushings, paper or gaskets.